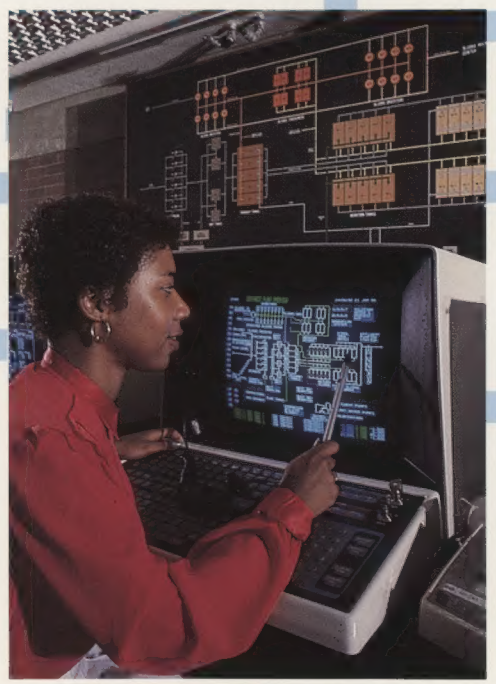
The Philadelphia Water Department



1987 Annual Report

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W. Wilson Goode
Mayor

James Stanley White
Managing Director

William J. Marrazzo
Water Commissioner

On The Cover:
Renita Freeman, Computer Programmer, checks one of 5,000 points monitored by the computer at the Southwest Water Pollution Control Plant.

Productivity Through Computerization

Placed into service in 1956, the Philadelphia Water Department's first analog computer was used to solve intricate hydraulic problems involving new water mains and their flows.

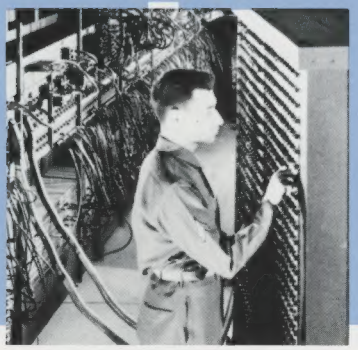
Like it or not, there is a computer in your future. In fact, to a large degree it's already here, regulating your automobile's engine, producing your bank statement, operating an automated bank teller, generating your paycheck, and controlling the water and wastewater treatment plants operated by the Philadelphia Water Department.

What is a computer? Computers are basically simple machines and, at the same time, very complex ones. They perform simple operations — like turning a switch on or off — but so quickly, in such great quantity, and in such small space that they seem incredibly complicated. Computers are programmable; that is, they can store and follow instructions given to them by human operators. An example of a familiar, simple programmable device is an alarm clock. What distinguishes computers from other programmable devices is their ability to calculate. When a computer prints out a paragraph in English or produces elegant designs on its screen, what we see is the result of the manipulation of numbers translated into visual displays or language. The computer is a powerful calculator that can store and follow instructions or programs, but understands only numbers.

Rapid Development of Computers

In 1946, the world's first electronic digital computer called ENIAC became operational in Philadelphia. Designed and built by the Moore School of Electrical Engineering at the University of Pennsylvania, its vacuum tubes, wires and switches occupied a 30 by 50 foot room.

The second generation of computers which used transistors instead of vacuum tubes was followed by a third generation using integrated circuits in 1965, and finally by



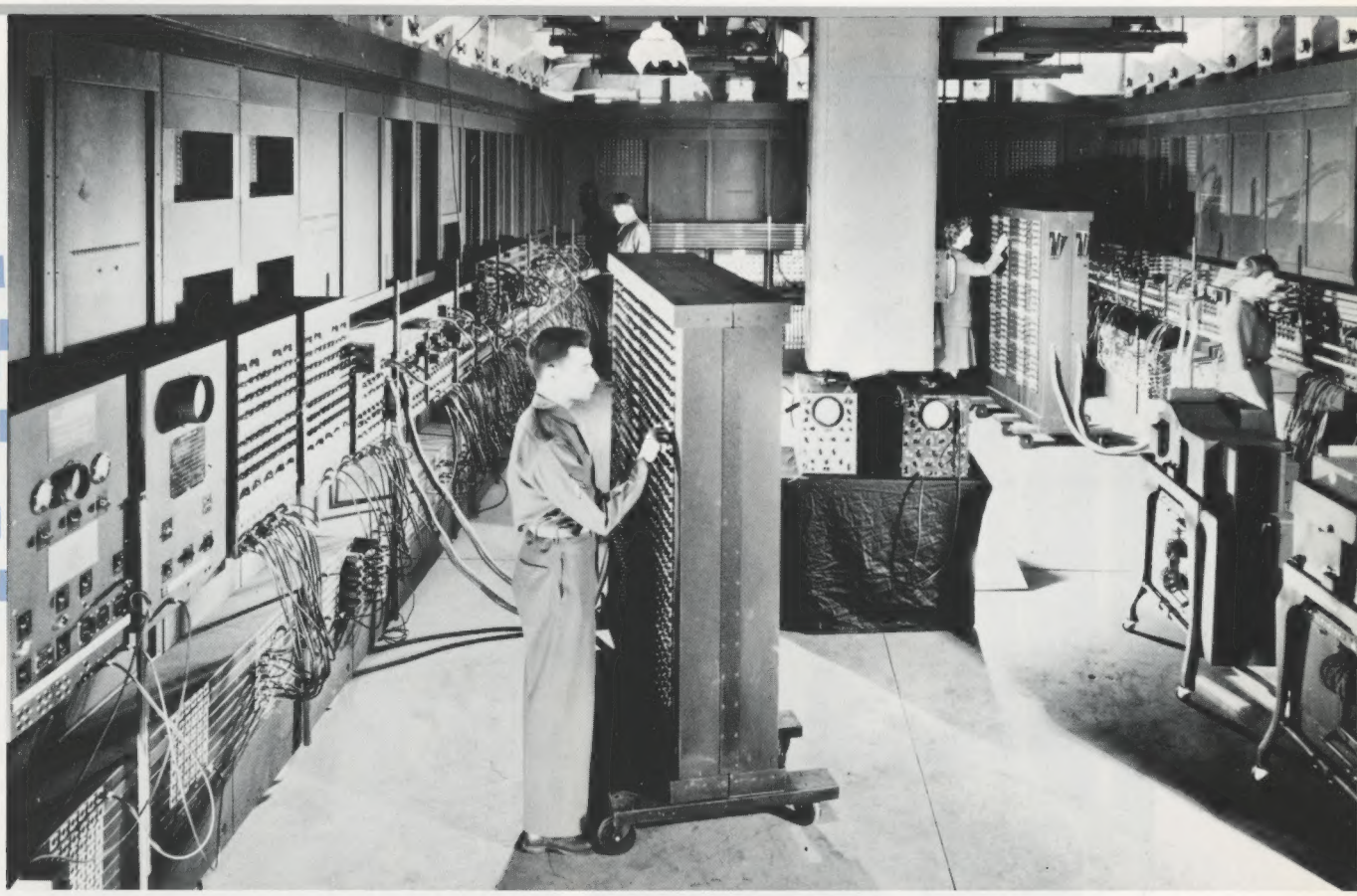
a fourth generation of computers in 1971 which used microprocessors. A microprocessor is a powerful electronic brain etched on a single silicon semi-conductor chip which contains the basic logic, storage and arithmetic functions of a computer.

To comprehend how fast computers have developed since 1946, consider this. In 1971, the first Intel microprocessor put 2,250 transistors onto a chip one-sixth of an inch long and one-eighth of an inch wide, yet it was almost as powerful as ENIAC which weighed 30 tons, used 18,000 vacuum tubes, and required so much power that the lights of West Philadelphia were said to have dimmed each time it was turned on. However, the present state-of-the-art in microprocessor development is the 32-bit which packs over 275,000 transistor gates on a single chip and can execute three to four million instructions per second!

Department's First Computer

Recognizing the engineering potential of computers for water utilities, the Philadelphia Water Department installed its first analog computer in 1956. This McIlroy fluid network analyzer was used for solving complex problems of planning the size of water main extensions and water flows into the developing areas of the City.

The Department's Load Control Center, one of the first of its kind in the United States when it began operation in 1960, had a computer, crude by today's standards, that used vacuum tubes. A system of electronic controls and high speed intelligence monitored water pressures, rates of flow, levels in water mains, reservoirs and pumping stations in the distribution system throughout the City. To prepare for complete computer control, the Department replaced the vacuum tubes with solid state equip-



The world's first electronic computer, developed at the University of Pennsylvania's Moore School of Engineering during World War II, utilized 18,000 vacuum tubes.

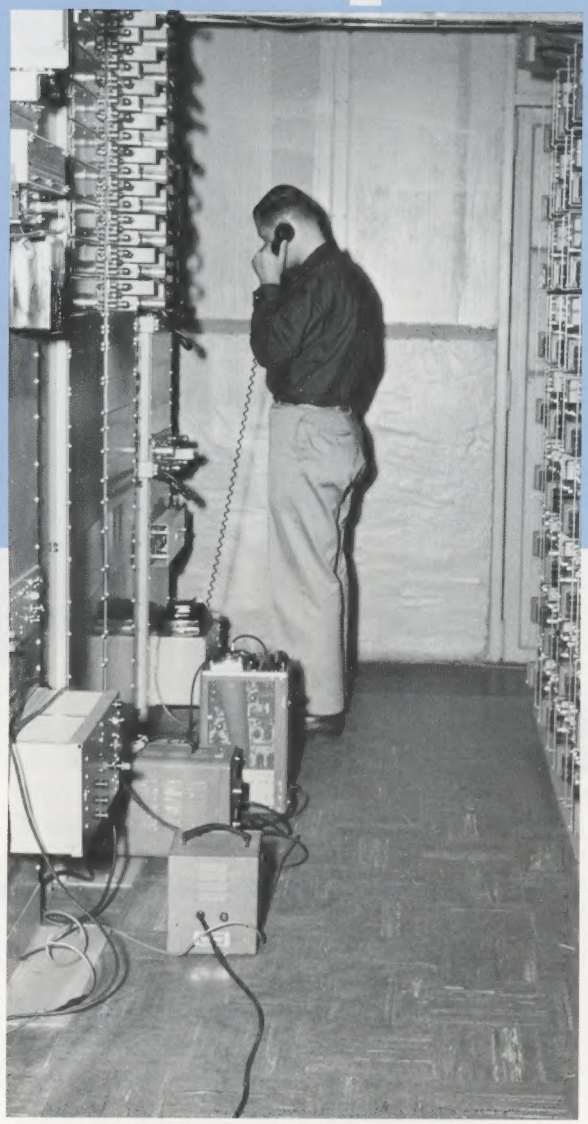
ment and a modern digital computer in 1970.

Today, data is picked up by electronic sensing devices at 120 points in the water distribution grid and is relayed by a ring of seven microwave towers to the control center. Complex equipment then deciphers the incoming signals and translates them automatically into meaningful information on typewritten sheets and digital displays. As a result, there are no operating personnel in any of the 16 pumping stations. By simply pushing a button, the operator at the control center can start or stop pumps and open and close valves in the remotely located stations.

Automating Wastewater Treatment

Computerization and process control have brought the technologies of the future into every division of the Water Department. An integral part of the $900 million wastewater treatment expansion program begun in the mid 1970's included the introduction of Process Control Centers (PCCs) in each of the three water pollution control plants.

Since the inception of wastewater treatment, the very processes which cleansed our wastewater were mechanically motivated, e.g., screening, collecting, sedimentation...all physical operations which necessitated manual maintenance and labor.



In 1959, the Water Department's Load Control Center used this microwave receiving and transmitting equipment in conjunction with a computer.

The expansion of the Department's three wastewater treatment plants added a "biological" component to wastewater treatment, specifically the use of aerobic and anaerobic bacteria to supplement pathogen kill and the settling out of additional sludge. Such secondary treatment added a vital component to our once solely "mechanical" sludge removal process and has enabled the Water Department to remove 92 percent of the pollutants from its wastes, in full compliance with the Clean Water Act.

The addition of modern treatment methods logically led to the incorporation of computer technology to monitor and control these processes. A good example is the Southwest Water Pollution Control Plant, which fully commissioned its central monitoring and control system during Fiscal 1987. The availability of this system has drastically changed the way treatment operators and management operate the plant. The computer monitors over five thousand points throughout the facility and automatically controls over 2000 pieces of equipment by programmed responses to process changes. One operator can also control all treatment processes manually from the Process Control Center or from any of the four field computer stations. When any piece of equipment starts, stops or changes any of its operating conditions, a status change immediately appears on all the computer monitor screens and in printouts at the Process Control Center. Abnormal operating conditions will generate an alarm. These features allow the two

Bob Overton, Treatment Plant Operator II, Southwest Water Pollution Control Plant.
"The Process Control Computer has allowed us to become more efficient, freeing us up to do more detailed checks."

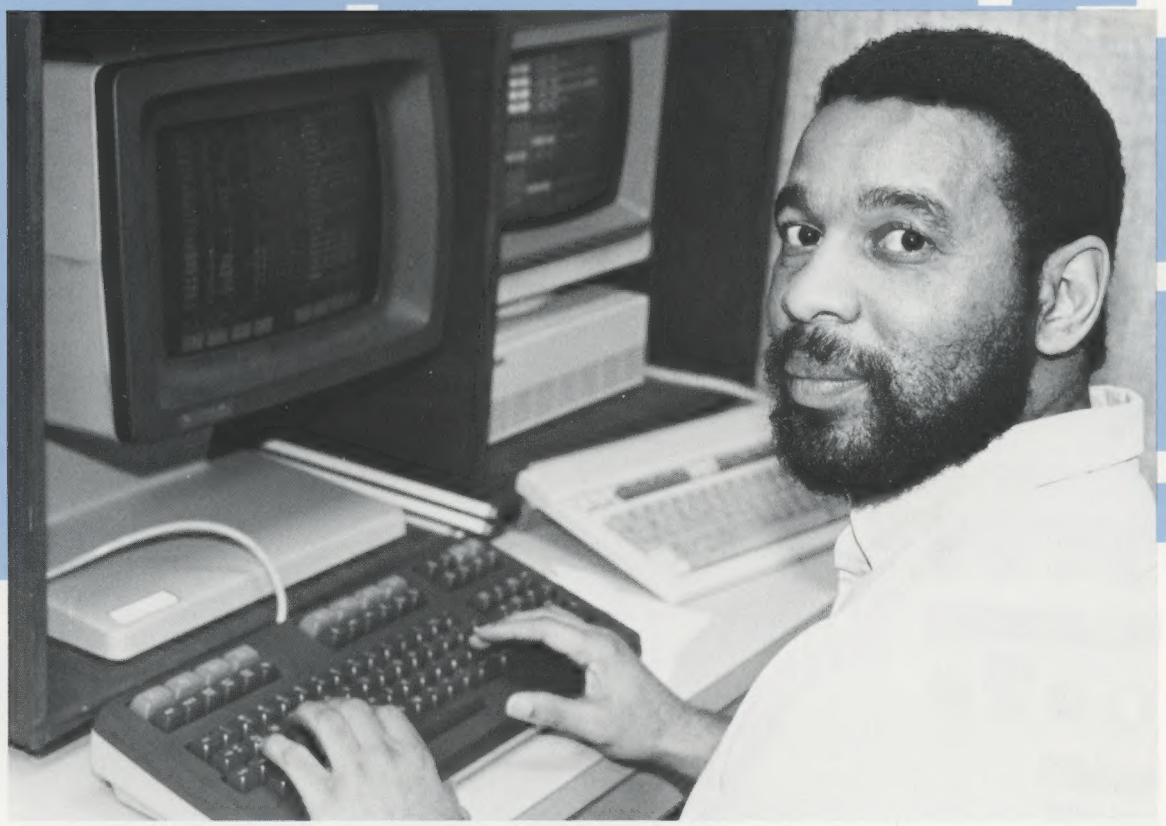
operators stationed around the plant to react promptly to situations as they occur.

Routine operating reports are automatically printed each evening by the computer, eliminating much of the manual calculations and logging. Maintenance schedules based on equipment operating times are also automatically printed and displayed on the monitor screens.

Improving Water Treatment with Computers

Trends in water treatment reflect the same commitment to the use of computer technology. Although it is fair to say that water treatment still consists of the basic processes such as natural sedimentation, pre-chlorination, chemical treatment, flocculation, sedimentation, filtration and post chemical treatment, the technologies employed today to accomplish these same tasks have revolutionized a century old industry. From the early 20th century practice of manually shoveling sand filter media into sand "washers" which resembled cement mixers, we have radically progressed to simply pushing a button at a process control center, thereby filling and emptying tons of water into a filter tank, effectively backwashing and cleansing the filter media.

Completed in 1987 after four years of construction, the Queen Lane Water Treatment Plant's new $10 million computerized automation system is able to vary chemical feeds with changes in water flows, auto-



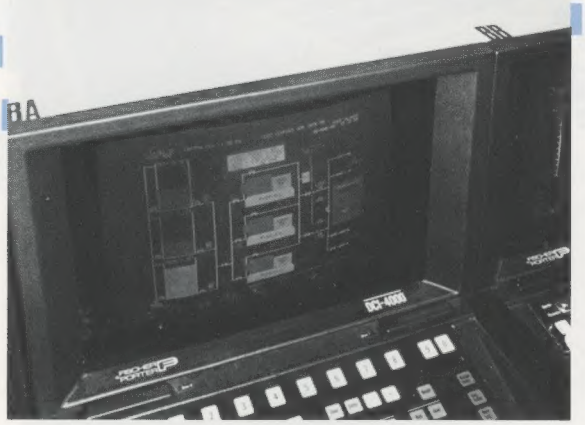
Heyward Johnson, Application Programmer Collector Systems.
"The Combined Sewer Overflow computer program allows us to monitor our regulating chambers...We can send out a repair crew immediately to the right spot."

matically backwash filters and provide extensive alarm and monitoring capabilities.

One operator can now operate the entire plant from the Chemical Control Center or Filter Control Center. The system can monitor and display on computer video screens all tank levels, process waste flows, chemical flows, plant turbidity, filter head loss, and the operational status of all power-operated equipment. If the digital system is out of service, there is manual back-up in both the control center and at the power-operated equipment locations. When tank levels or process flows vary from predetermined limits, alarms ring and the information is displayed on the computer video screens. A far cry from the days of shoveling filter sand!

Computerized Version of Street Map

The Waste and Stormwater Collection Division maintains approximately 3,000 miles of combined storm and sanitary sewers, 80,000 manholes, 75,000 stormwater inlets, 174 combined sewer regulators, and over 200 acres of drainage right-of-ways. To decrease the amount of time spent identifying the exact location of a customer complaint and the enormous amount of paperwork generated by 100,000 service requests each year, the Department created the Collector System Operation Information System (CSOIS). This system differs from typical management information systems in that its primary objective is to assist the unit supervisor in logging service requests, scheduling



Joe Pace, Treatment Plant Operator II, Queen Lane Water Treatment Plant.

"I was surprised at how well computers have worked at Queen Lane. I didn't think that 21st century technology would blend with 20th century motors and valves."

work, printing work orders, tracking backlogs, achieving maintenance histories, and generating standard reports.

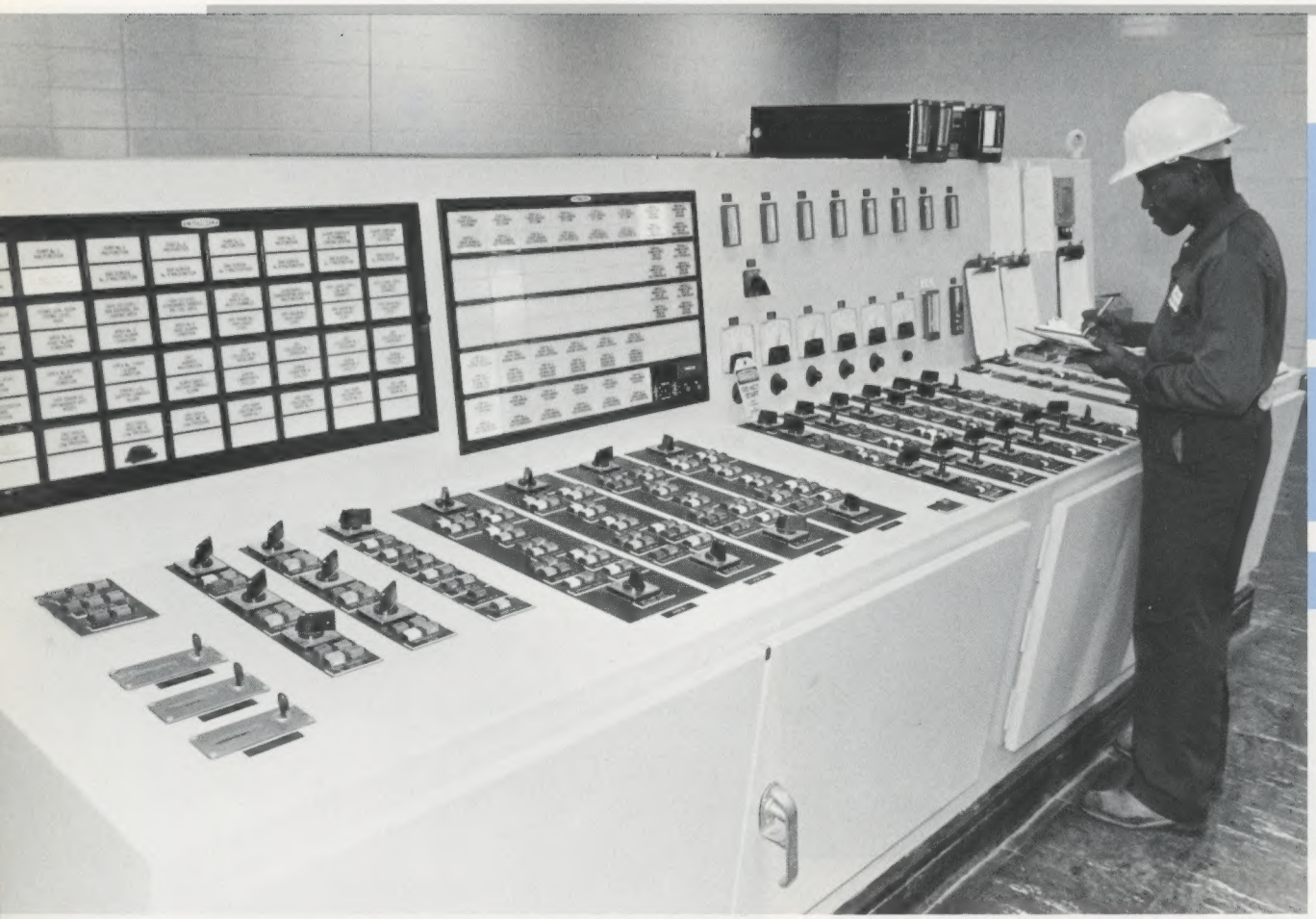
The central component of the CSOIS is a 1980 geographic base file which is actually a computerized version of a street map containing all the features shown on a U.S. Census Bureau's Metropolitan Map Series. It also shows block-by-block address ranges, zip codes, and X-Y coordinate values at intersections. Once the geographic location is identified on the computer screen, the operator can identify the facility in need of service to satisfy the request, provide the requester with the work history for that facility, the current backlog, and the estimated response time. When a service request is logged onto the system, a work in progress entry is generated. Accessing this information through a computer terminal, supervisors evaluate and prioritize jobs, develop work schedules, and print work tickets. Completed work orders are entered daily, creating a current record.

Because the system's central log is the geographic base, there is no limit to how many operation information systems it can support. Additionally, there is no need to develop all Operation Information Systems (OIS) simultaneously. Each OIS is separate from the others, yet all have one common element — the geographic base. The base maintains the potential to link all OISs once those systems have been developed.

Currently, the CSOIS consists of an Inlet Cleaning OIS, a Sewer Maintenance OIS, and a Drainage Information System. The latter is a computerized system which contains more than 32,000 records of vital as-built sewer return plan information for the collector system network.

Controlling Stormwater Flows

The CSOIS program has led the Water Department to work on the development of



Anthony Goodwin, Treatment Plant Operator, remotely controls all of the process equipment in the Preliminary Treatment Building at the Northeast Water Pollution Control Plant from one computer console.

an "in-line storage" system to limit stream and river pollution from its 500 stormwater outfalls. The 174 regulating chambers installed within the combined sewers along the City's waterways act as relief valves, allowing excess wastewater to empty into streams and rivers during periods of heavy rainfall.

The Water Department's own data, developed as part of a regional research effort in the mid-1970's, showed that a high percentage of pollutant loading from Combined Sewer Overflows (CSOs) was carried in this first flush, the initial surcharge which sweeps sewage solids over outfall weirs into waterways during major storms. The "first flush" of rain also carries a high percentage of gasoline, oil, debris, trash and other pollutants washed in from the street. Research data indicated that the City's large combined collectors could retain a good portion of the first flush under controlled conditions, thus reducing pollution to local streams and increasing the percentage of storm flow handled at the City's three wastewater treatment plants.

Over the period from 1978 to 1980, three prototypes were developed for the inline storage system, modifying three sewer regulators in order to control flow from remote locations. These prototypes were linked to the Water Department's host computer at the Northeast Plant by leased data lines, allowing control of the regulator gates to balance upstream flooding and bypass.

Incoming wastewater from sewage lines in the Northeast are raised by five 85 mgd influent pumps located in the Preliminary Treatment Building of the Northeast Water Pollution Control Plant.

To control this storm water run-off, 63 monitoring stations which consist of instrumentation such as flow level sensors and rain gauges have now been installed in combined sewers throughout the Northeast section of the City. Signals from these field instruments are transmitted to a process control computer located at Sewer Maintenance Headquarters, notifying operating personnel when combined sewers are near capacity. By operating the discharge gates remotely from Sewer Maintenance Headquarters, stormwater flows can be controlled instead of being automatically released into rivers and streams. In the future, the entire intercepting system will be designed to control the first flush. Wastewater flows from outlying townships will also be monitored to determine the effects of suburban inflow into Philadelphia's system.

Computerized sewer surveillance has enabled Philadelphia to implement the latest technologies to maintain efficient operation of its collector systems. Not only is the Department able to collect better quality data, but the overall cost savings in maintenance and operation processes enables the City to pass these savings on to its customers.

Environmentally, the value of the program is immeasurable. In-line storage and outfall control is a giant step in Philadelphia's long-time efforts to curb the pollution of our waterways. This project represents Philadelphia's firm commitment to revitaliz-

Edward Weklar and Allen Smith, Treatment Plant Operators, inspect the final sedimentation tanks at the Northeast Water Pollution Control Plant.

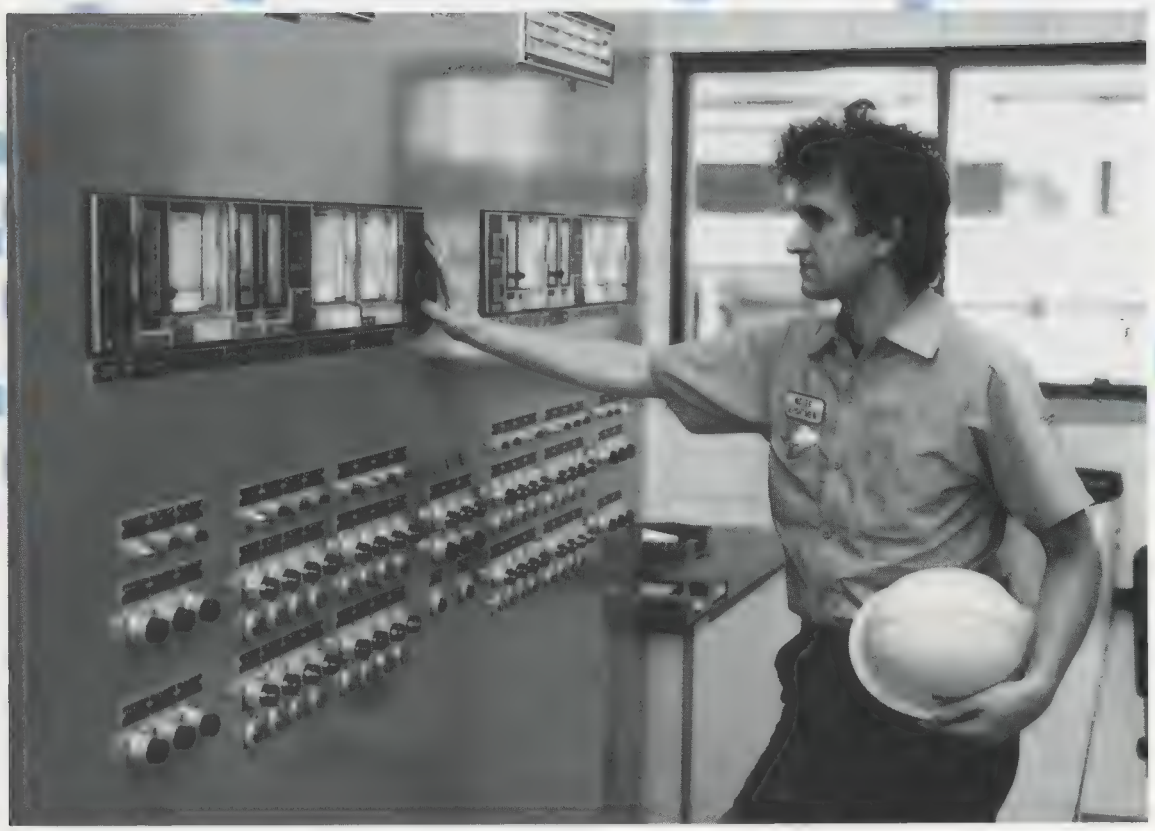
ing our waterways by reducing non-point source pollution and waste overflow.

Data Management Center

The Water Department's Data Management Center was created in 1965 to aid the Department's engineers with the planning and designing of various operational processes and applications. The amount of time and money once invested to perform such tasks as designing new water mains and sewers, and evaluating data for better wastewater treatment or for more accurate determination of chemical dosages in water purification has decreased significantly.

The Computer Center started with an IBM-1620, and to illustrate how primitive data processing was in 1965, the original system used the console typewriter for printed outputs, had no disc storage and required card read and punch machines to translate programs into machine readable format. The IBM-1620 was replaced by the IBM-1130 in 1967 and remained in place until 1976 when the Hewlett-Packard (HP) 3000 series II computer system was installed. The current Hewlett-Packard model 3000/70 has developed into a system configuration which includes 10 million bytes of memory capability, 2 billion bytes of disc storage and supports a network of over 200 terminals, printers and plotters distributed throughout the Department's facilities.

The card-oriented batch environment of 1976 was rapidly transformed into the interactive on-line environment of the 1980s



Operator observes Control panel in Compressor Building at the Southeast Water Pollution Control Plant which houses three 9,000 cubic foot per minute air blowers and two 1,000 horsepower multi-stage air compressors.

with databases replacing flat files and full screen terminal entry supplanting punched cards.

Currently, the HP computer system supports over 19,000 files, 100 active projects and 100 databases spanning all five divisions of the Water Department. Among the most recent computer applications are data based systems for Electronic Meter Reading, Customer Information, Hydrant Maintenance, Inlet Cleaning, Capital Projects and Personnel Injuries.

Improved Billing Information System

The primary objective of a good customer billing information system is to provide a fast, efficient and comprehensive means of processing water/sewer related billings and payment, effective enforcement, and the appropriate support for fair and responsive customer service. Recognizing that the present water/sewer customer billing system developed in 1976 did not meet this objective, the Water Department recently proposed and received approval from City management to assume these data processing responsibilities.

To prepare for the new billing system, the Department has developed an additional data center and acquired an IBM-4381 computer to manage water billing procedures. The new system consists of the IBM-4381-14 CPU with two separate processors, 32 million bytes of memory, 10

Margaret Marcus, Service Representative, enters a customer's inquiry into the new computerized system, insuring a prompt response to water or sewer problems.

billion bytes of disc storage, 4 tape drives, a high speed XEROX laser printer and an NCR fronted processor that manages the data communication between the billing system, the City's mainframe, and the Department's Hewlett-Packard computer.

The actual transfer of the billing system from the City's mainframe will coincide with the installation of a brand new software system that will inaugurate monthly billing and signal the end of the present quarterly billing cycle. The new system will eliminate the vast majority of manual searches, usage calculations and time-consuming report preparations which are required by the existing system.

Computerized Customer Information

The Water Department's Customer Information Unit, which has recently expanded to include additional service representatives with computer terminals, operates from the Department's Headquarters at the ARA Tower at Reading Center. When a customer telephones with a service request, the new computerized system allows the representative to type the location into the computer terminal, check on the service history for that address, and immediately transmit the request to a designated printer at the City Hall Radio Dispatcher or one of the Department's operating units. The computer stores the information and the printers provide a permanent copy for the work crews at the Meter Shop, Emergency Desk, Hydrants, Customer Service, Inlet Cleaning, and Sewer

The new hand-held microprocessors increase both the accuracy and speed of readings, reduce paperwork, and have the capacity to record information for over 800 water meter accounts.

Maintenance. The progress of a complaint can be checked periodically by calling up the location on the computer video screen. Operating units will input services checked, problems found, action taken and completion dates, so that the representatives have all the current information available to respond to the customers.

Word Processing

To achieve a more efficient means of typing correspondence, engineering reports, form letters, and design specifications, the Department established a Word Processing Center in 1985. The center consists of nine work stations, one central terminal that includes a mini-computer, and three laser printers. One of the work stations has been wired to communicate with the HP computer and a Xerox 5700 printer/copier with a wide variety of print styles and sizes. A Dial Dictation system can be used from any telephone at any time to dictate to the Word Processing Center.

Ginger Ertz, Librarian, Water Department Library.
"The computer has improved our research ability tremendously...we can find information in minutes that in the past took engineers days or weeks to find."

Library

The Water Department's library can access bibliographic or full-text databases at the touch of a computer keyboard. Research on topics from Anaerobic digestion to Zinc can be performed in minutes using hundreds of electronic databases which index thousands of journals, books, and other resources. In addition to these outside information services, the Department's book and periodical collection are being cataloged on-line in our own in-house database. With this combination of in-house and outside electronic services, any information needs from technical to managerial can be satisfied quickly and with the most up-to-date publications available.

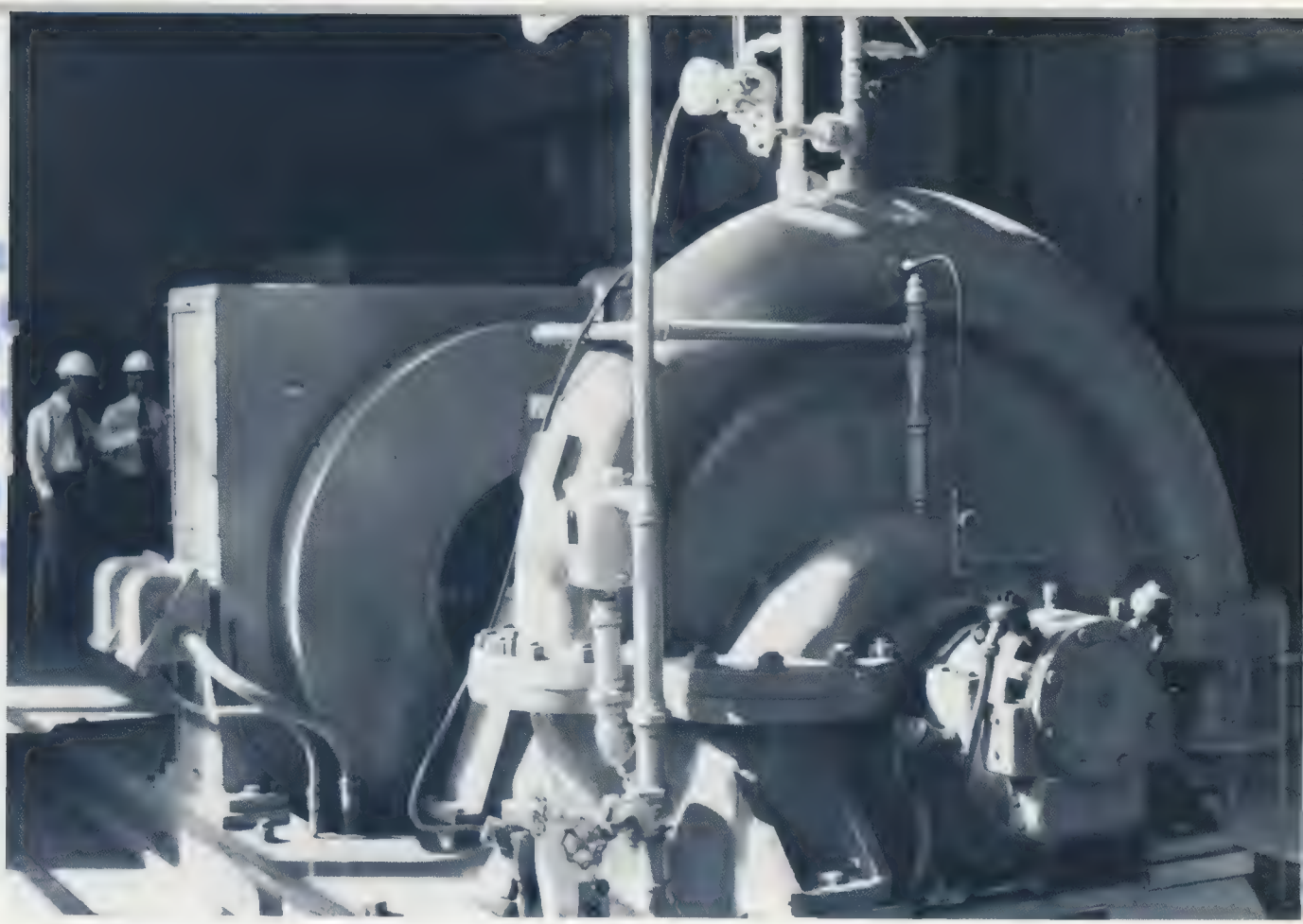
Department's Commitments to Microchip Management

Microchips now turn the wheels of the water and wastewater industry. Microprocessors speak not only to humans but also carry out two way conversations with pumps, valves, reservoirs, and with each other. They read meters and prepare water/sewer bills for customers.

By 1990, all of the Department's pumping stations, and water and wastewater treatment plants will be controlled and monitored by computers. Virtually every part of its operations will be assisted in some way, by computerization. Mastery of microchips will require the re-education of many of the Department's employees. Thousands of training hours have already been devoted to this education program and many more are planned for the future.

Although the cost is high, the Philadelphia Water Department is convinced that its investment in computer technology will lead to improved productivity, higher water quality, less river pollution, and better customer service.

Operations



A 2,000 horsepower motor drives this 30 mgd pump at the Belmont Raw Water Pumping Station.

Water Treatment

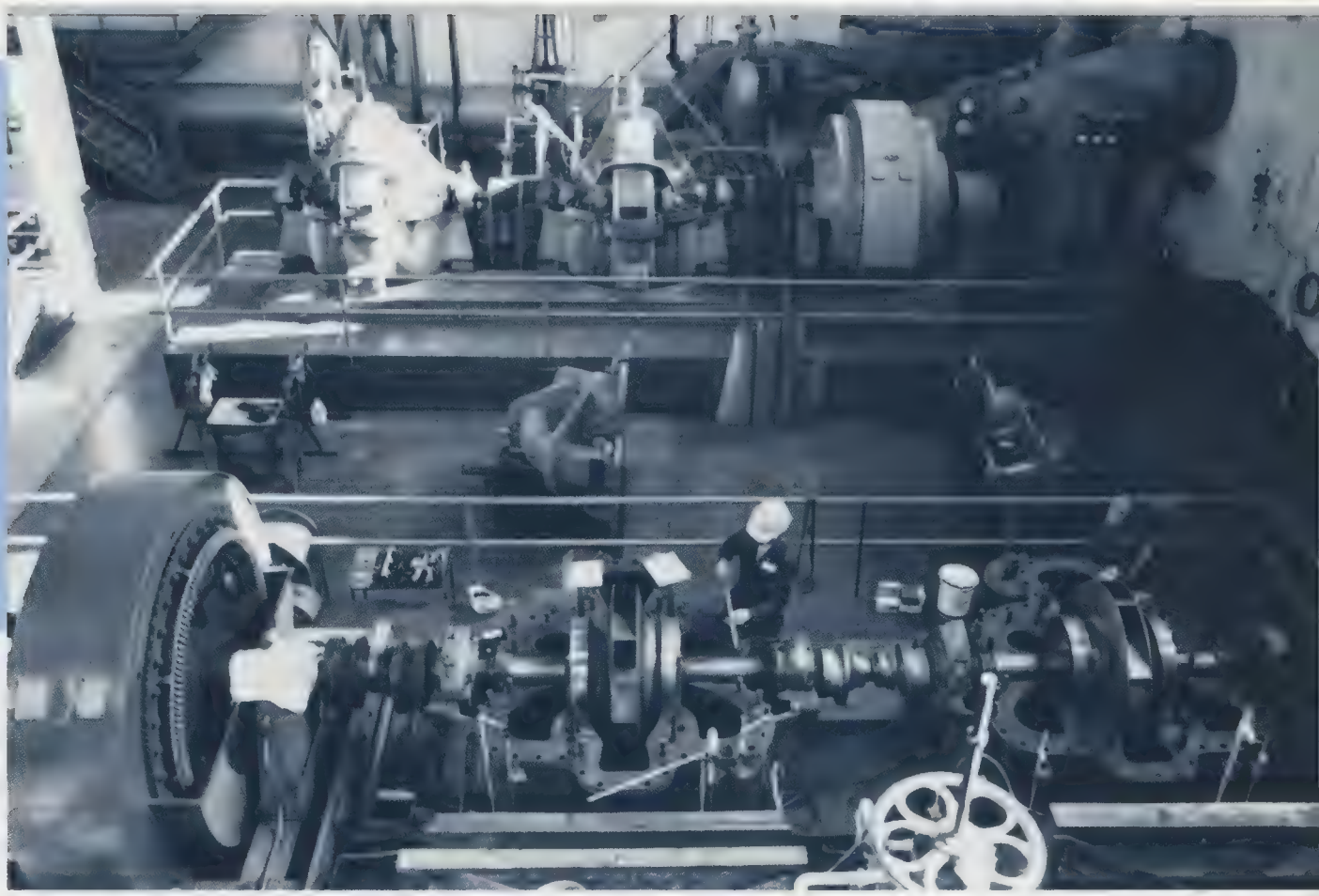
Philadelphians used water at a rate of 321.6 million gallons daily (MGD) during Fiscal 1987 compared to 315.8 MGD in 1986. Another 15.5 MGD was pumped and sold to the Bucks County Water and Sewer Authority.

Pumping strategies have been refined to maximize cost savings by taking advantage of reduced electric rates during off-peak hours. The Load Control Center was able to reduce electrical costs in Fiscal 1987 by $250,000 while delivering an additional 2.5 billion gallons of water compared to 1986.

Fortunately, the Water Treatment Plants had no difficulty in meeting this demand. Their rated capacity (543 MGD) was well in excess of public requirements and their total peak capacity (681 MGD) easily met high hourly and summer-time rates. Water quality was generally good in both the Schuylkill and Delaware watersheds and Philadelphia's drinking water met all state and federal regulations.

Water System Maintenance

A total of 39 pumps were completely dismantled, inspected, cleaned and repaired as part of the preventive maintenance program. This helped to increase average availability of pumps in Fiscal 1987 to 94.6 percent. Infrared testing was used at six pumping stations to determine potential faults in the 13.2 kilovolt switchgear, 2.4



Preventive maintenance assured that each of the six 30 mgd pumps at the Queen Lane Raw Water Pumping Station were in prime operating condition 95% in FY '87.

kilovolt motor circuits and related electrical distribution panels through the use of thermal photography. By pinpointing these potential failures before they happen, the necessary repairs can be scheduled, thus avoiding downtime, damage to equipment and costly emergency overtime.

Distribution crews met the constant challenge of maintenance problems in winter cold and summer heat. In Fiscal 1987, they repaired 609 broken water mains and renewed 154 valves.

Investigations by leak detection crews revealed 402 water main leaks, estimated to be wasting 8.043 million gallons of water per day. Eliminating the leakage saved $293,570 in pumping and chemical costs annually.

During 1987, Emergency and Support Services installed 4,293 ferrules where registered plumbers were repairing or installing new water services. Over 2,700 valves were inspected and almost 8,000 fire hydrants were repaired. To prevent unauthorized openings of fire hydrants during the summer, crews installed over 2,300 locking devices.

Called the "cash registers" of the Water Department, there are 498,059 water meters in the system varying in size from 5/8 to 10 inches. As part of the Department's 10-year program to replace old mechanical meters, 30,034 new 5/8 inch magnetic meters were installed during Fiscal 1987.

Rebuilding large valves in the Department's Machine Shop yields considerable cost savings.

On September 2, 1986, a fire at the Department's main automotive garage on Logan Street necessitated its demolition. Despite the loss of inventory and equipment, and a relocation to 1123 Adams Avenue, the unit performed 29,425 job operations in 1987 including repairs, preventive maintenance checks and state inspections.

Wastewater System Developments

During Fiscal 1987, 472.68 million gallons per day (MGD) of wastewater were treated at the three water pollution control plants. The average influent concentrations of 199 milligrams per liter (mg/l) suspended solids (SS) and 130 mg/l biochemical oxygen demand (BOD) were reduced to 29 and 22 mg/l of SS and BOD in the effluent discharged from the plants. These are the key parameters measured to determine the effectiveness of a wastewater treatment facility. For the first time in the Department's history, wastewater treatment plant effluent quality was consistent with the definition of secondary treatment — achieving SS and BOD of 30 mg/l or less.

Plant operation highlights included start-up of the modernized Southeast Plant in mid-fiscal year, reconstruction and operation of the Southwest Plant Chlorination facility, consistent plant dewatering using the Bird Centrifuges, and the continuous operation of various unit processes at the Northeast Plant including the new Final Sedimentation Tanks and the Preliminary Treatment

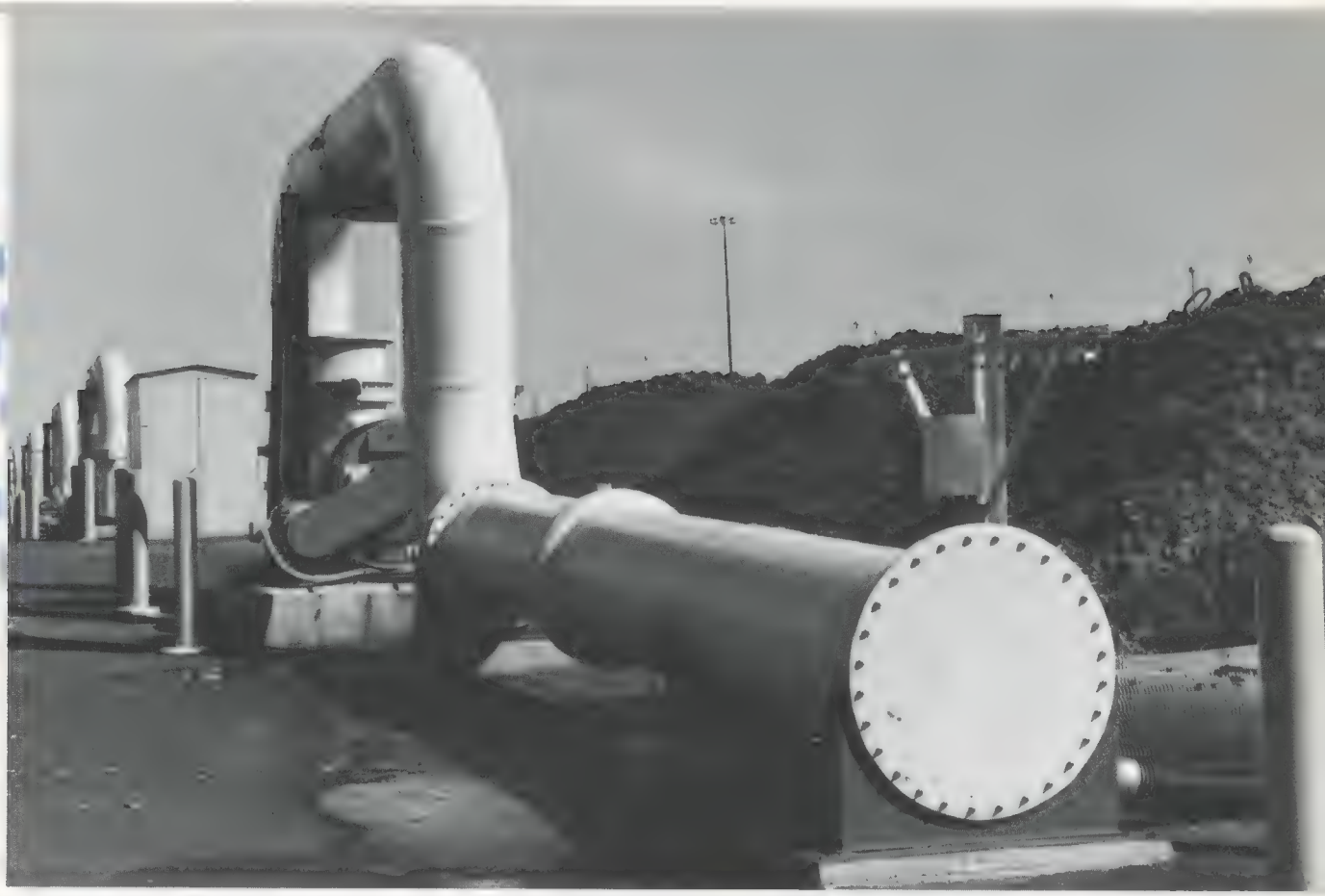
Liquid sludge will be stored in this tank under construction at the Northeast Water Pollution Control Plant before being barged to the Sludge Processing and Distribution Center.

Building. Although 10,000 hours of training were given to the operations and maintenance staffs at all these plants in 1987, the training programs will continue in full swing during Fiscal 1988.

Industrial Waste Control

In Fiscal 1987, inspectors also collected 297 composite or grab samples of wastewater, the basis for levying $3.7 million in surcharges on industrial wastes with strengths above the specified limit. The industrial surcharge, authorized under a 1977 ordinance, imposes strict limits on the discharge of heavy metals, oils, greases and other substances by Philadelphia industries to help the City meet federal standards for wastewater plant effluents, improve sludge quality for land application, and protect the Department's plants from treatment upsets.

There are eleven townships bordering the City of Philadelphia that discharge into the City's sewer system and treatment plants



Air is supplied by twenty-seven 75 horsepower centrifugal blowers to the sludge composting piles to speed up the natural process of organic decomposition.

through 35 connections. Bills, amounting to $14.2 million during Fiscal 1987, are based on both the flow and strength of the sewage in accordance with contracts that have been negotiated with each township.

Sludge Composting

Federally imposed levels of wastewater treatment have generated additional quantities of sewage sludge. The Department has a recycling system that utilizes the valuable nutrients in the sludge to form a marketable soil conditioner.

Because existing composting facilities could not accommodate the additional sludge, in 1985 the City started construction of a large scale composting facility, the Sludge Processing and Distribution Center (SPDC).

With its completion in the fall of 1988, the facility will be capable of processing up to 400 dry tons of sludge daily. This federally funded facility is the largest in the U.S. and one of the largest in the world.

The present composting facility received 59,335 dry tons of sludge solids for processing in Fiscal 1987, 10,276 dry tons more than in the previous fiscal year. Of this total, 35,000 dry tons of sludge products were utilized in the marketing program for nurseries, greenhouses and farmland.

Sewer System Maintenance

Over 210 employees in the Sewer Maintenance Unit performed 25,815 jobs during 1987 to keep the 2,946 miles of

Sewer inspectors, following stringent safety procedures, checked 45 miles of sewers during 1987.

sewers clear of debris. They walked or crawled through 45 miles of branch sewers to check their condition. Another five miles of smaller sewers were examined with a television camera.

Crews also cleaned 60 miles of sewers by high pressure flusher and a mile by the mechanical bucket machine. They rodded almost a mile of sewer and cleaned debris from 44 acres of streams and their banks.

Since 1968, when the job of cleaning 75,000 sewer inlets was transferred from the Streets Department to the Water Department, crews have responded to hundreds of thousands of requests for service. The responsibility of cleaning and maintaining 537 inlets in Fairmount Park was added in 1972.

Cleaning 53,542 stormwater inlets on City streets in Fiscal 1987, crews removed 1.8 million cubic feet of debris. They also replaced 3,142 missing inlet covers which presented hazardous situations to pedestrians.

Management and Engineering Services

This $6 million 6 by 12 foot twin box sewer in Richmond Street will provide storm flood relief in the Kensington area of Philadelphia.

Revenue Bonds

On January 10, 1986, the Water Department raised water and wastewater rates to meet the projected revenue requirements through June of 1987. Through a series of successes in the areas of revenue enhancement and cost containment, the Department was able to eliminate a projected $35 million revenue shortfall for Fiscal 1988, thereby avoiding another rate increase.

In June of 1986 the Water Department received an "A" rating on its twelfth Series Revenue Bond issue from the Standard and Poor's bond rating agency. Maturity dates ranged from 1989 out to the year 2016. This rating enabled the Department to sell $178 million of revenue bonds at a competitive 7.87% average interest rate. Proceeds from this sale raised sufficient revenues to fund the Department's capital expenditures for three years through the Capital Improvement Fund.

Engineering

Previous sales of revenue bonds enabled the Department to proceed with 110 projects during Fiscal 1987, including 30 miles of new water mains and sewers valued at $20 million and improvements to pumping stations, treatment plants and reservoirs costing another $69 million. This work was monitored and inspected by the employees of the Construction Branch. To prepare for future work, the Design Branch's engineers and draftsmen completed the plans and specifications for 90 contracts worth $19 million.

Employee Suggestion Award

Since the Program's inception in 1986, 102 Employee Suggestions have been submitted

with 16 adoptions (15.7%). The adopted suggestions include those that reduce electrical usage, maintenance of machinery costs, and time spent to repair sewer inlets. They are saving the Department about $30,000 each year in operating costs.

Occupational Safety and Health Program

During 1987, the Department's Occupational Safety and Health (OSH) Program expanded significantly. Injury prevention efforts were highlighted by a comprehensive training program covering topics from Right-to-Know Law Compliance to various aspects of operational safety. Over 1600 employees attended the 134 seminars offered by the Department's OSH Office staff.

Customer Assistance Program

The Philadelphia Water Department has been concerned about the increasing number of low-income households that cannot afford water services, heat-related or otherwise, and has developed and participated in a variety of programs to address this issue: the Utility Emergency Services Fund (UESF); a Water Department conservation program coordinated with the Energy Coordinating Agency of Philadelphia, Inc.; discounts for Philadelphia Housing Authority properties and senior citizens; and legal aid for customers facing shut-off.

Initiated on August 4, 1986, the Customer Assistance Program, "Water CAP," administered by the Customer Affairs Division, helps low-income water customers by making minor plumbing repairs, installing water conservation devices, and providing referral information to cash assistance programs.

New Logo

The Philadelphia Water Department takes pride in serving over 500,000 water and wastewater customers in the greater Philadelphia area. The agency has committed itself to providing the highest quality

The roof of the Fairmount Water Works Pavilion, which was built in 1871, was raised to facilitate the removal of the huge wooden columns for restoration.

of community service. In keeping with its tradition of community involvement, the Department sponsored a logo contest in 1987 to develop a contemporary and lasting symbol of that commitment. The contest was open to all matriculated undergraduate students of accredited design schools and universities within the City of Philadelphia. The grand prize was won by a student of the Philadelphia College of Arts and a modified version of the logo is gradually being introduced throughout the Department.

Restoring the Fairmount Water Works

The Fairmount Water Works, a major Philadelphia landmark, opened in 1815 and ceased operation in 1909. After its closing, the Water Works fell into disrepair. It wasn't until September 1979 that the City started seriously examining ways of restoring the Water Works. The Water Department took the leading role in this endeavor and contracted with an architectural and planning firm to do an Adaptive Reuse Feasibility Study, which was completed by September 1981. Since then, the Water Department, working with the Junior League of Philadelphia, the Fairmount Park Commission, and the Pennsylvania Coastal Zone Management Program, has explored the recommendations of the Study. During Fiscal 1987, a consultant completed a feasibility study and preliminary design for the Fairmount Water Works Interpretive Center. The consultant designed an educational facility which will inform visitors of all ages about the history of the Water Works and water supply in Philadelphia, current water quality, and technology issues, as well as the ecologies of Fairmount Park and the coastal zone.

During Fiscal 1987, the roof of the Pavilion was raised to remove the huge columns for restoration and the aquarium and the terrace deck were demolished. A stormwater sewer outfall was bulit under the Old Mill House, and a new deck was constructed.

Supplemental Schedule Of Rate Covenant Compliance For Fiscal Year Ended June 30, 1987 (Amounts in Thousands of Dollars) (Legally Enacted Basis)

Line No.		
1	Total Operating Revenue	$239,273
2	Net Operating Expense	136,001
3	Bond Anticipation Notes	8,006
4	Net Operating Revenue After Notes	$ 95,266
	Debt Service:	
5	Revenue Bonds Outstanding	$ 70,641
6	General Obligation Bonds Outstanding	17,484
7	Total Debt Service on Bonds	$ 88,125
8	Net Operating Revenue after Bonds	$ 7,141
	Nonoperating Income:	
9	Interest Income	$ 10,804
10	Grant Income	4,025
11	Total Nonoperating Income	$ 14,829
	Other Obligations:	
12	Direct Interdepartmental Charges	$ 23,766
13	Transfer of Interest Income to General Fund	4,137
14	Renewal and Replacement Fund	4,272
15	Repairs and Maintenance Financed from Revenues	814
16	Engineering and Administration Financed from Revenues	2,155
17	Total Other Obligations	$ 35,144
18	Net Operating Balance for Current Year	$ (13,174)
19	Net Balance at Beginning of Fiscal Year	42,136
20	Net Balance at End of Fiscal Year	$ 28,962

Property, Plant and Equipment

Property, plant and equipment at June 30, 1987 and 1986 consisted of the following:

	June 30, 1987	June 30, 1986
Land	$ 5,919,160	$ 5,919,160
Buildings and related improvements	827,003,232	436,036,511
Equipment	34,079,469	25,868,390
Transmission and distribution lines	941,333,611	900,769,956
Construction in progress	141,410,226	500,044,953
Total	$1,949,745,698	$1,868,638,970
Less accumulated depreciation	(573,264,220)	(540,177,802)
Total	$1,376,481,478	$1,328,461,168

Supplemental Schedule Of Rate Covenant Compliance For Fiscal Year Ended June 30, 1987 (Amounts in Thousands of Dollars) (Legally Enacted Basis)

Pursuant to Section 4.03(b) of the General Water and Sewer Revenue Bond Ordinance of 1974 (Bill No. 1263), the City is required to impose, charge and collect in each Fiscal Year rates and charges at least sufficient, together with that portion of the unencumbered amount of the operating funds balances available and reserved for appropriation for the payment of Operating Expenses at the commencement of such Fiscal Year, which together with all other project revenues to be received in such Fiscal Year, shall equal not less than the greater of:

A. The sum of:

(i) all Net Operating Expenses payable during such Fiscal Year;

(ii) 150% of the amount required to pay the principal of and interest on all Bonds issued and outstanding hereunder which will become due and payable during such Fiscal Year; and

(iii) the amount, if any, required to be paid into the Sinking Fund Reserve during such Fiscal Year; or

B. The sum of:

(i) all Operating Expenses payable during such Fiscal Year; and

(ii) all Sinking Fund deposits required during such Fiscal Year in respect of all outstanding Bonds and in respect of all outstanding general obligation bonds issued for improvements to the water or sewer systems and all amounts, if any, required during such Fiscal Year to be paid into the Sinking Fund Reserve.

Coverage is computed as follows:

Coverage A

Line 4	95,266
+ Line 11	14,829
+ Line 19	42,136
	152,231
/ Line 5	70,641
= Coverage A	2.15

Coverage B

Line 4	95,266
+ Line 11	14,829
− Line 12	(23,766)
+ Line 19	42,136
	128,465
/ Line 7	88,125
= Coverage B	1.46

Timothy Mack is supervisor of the new data center which will prepare 30,000 water and sewer bills daily when monthly billing begins in 1989.

Philadelphia Water Department
ARA Tower At One Reading Center
1101 Market Street
Philadelphia, PA 19107